WHAT IS CLAIMED IS:

1. A transcoding apparatus comprising:

a video decoding unit which receives a compressed bitstream and performs decoding thereof to output decoded pictures;

a complexity estimation unit which estimates complexity of a current picture among the decoded pictures to encode the current picture and provides complexity information of the current picture;

a target bit-allocation unit which performs desired bit-allocation using the complexity information of the current picture;

a bit-rate control unit which controls bit-rate using bit-allocation information and state information from memory, which outputs an encoded bitstream; and

a video encoding unit which encodes the decoded pictures on the basis of the bit-allocation and state information of the bit-rate control unit.

2. The transcoding apparatus of claim 1, further comprising an output buffer which stores and outputs pictures encoded by the video encoding unit, wherein state information of the output buffer is provided to the bit-rate control unit.

3. The transcoding apparatus of claim 1, wherein the compressed bitstream input to the video decoding unit is compressed in MPEG (Motion Picture Experts Group) format.

4. The transcoding apparatus of claim 1, wherein the complexity estimation unit calculates complexity of a picture to be currently encoded, using complexity of decoded previous and current pictures output from the video decoding unit and complexity of an encoded previous picture output from the video encoding unit.

5. The transcoding apparatus of claim 1, wherein if it is assumed that $\hat{X}_{out,I}$ represents complexity of a current I picture to be encoded, $\hat{X}_{out,P}$ represents complexity of a current P picture to be encoded, and $\hat{X}_{out,B}$ represents complexity of a current B picture to be encoded, the complexity estimation unit calculates $\hat{X}_{out,I}$, $\hat{X}_{out,P}$, and $\hat{X}_{out,B}$, respectively, as follows:

$$\hat{X}_{out,I} = \frac{X'_{out,I}}{X'_{in,I}} \times X_{in,I}$$

$$\hat{X}_{out,P} = \frac{X'_{out,P}}{X'_{in,P}} \times X_{in,P}$$

$$\hat{X}_{out,B} = \frac{X'_{out,B}}{X'_{in,B}} \times X_{in,B},$$

wherein, $X'_{out,I}$, $X'_{out,P}$, and $X'_{out,B}$ denote complexities of encoded previous pictures of the current I, P, and B pictures, respectively, $X'_{in,I}$, $X'_{in,P}$, and $X'_{in,B}$ denote complexities of decoded previous pictures of the current I, P, and B pictures, respectively, and $X_{in,I}$, $X_{in,P}$, and $X_{in,B}$ denote complexities of decoded current I, P, and B pictures, respectively.

6. The transcoding apparatus of claim 1, wherein the bit-allocation unit increases a number of bits to be allocated for the current picture if complexity of an estimated current picture is large, and decreases number of bits to be allocated for the current picture if the complexity of the estimated current picture is small.

7. The transcoding apparatus of claim 1, wherein the target bit-allocation unit calculates a number of bits to be allocated for the current picture using the complexity of the current picture.

8. The transcoding apparatus of claim 1, wherein the target bit-allocation unit calculates a number of bits T_I to be allocated for a current I picture, using the complexity of the current picture, as follows:

$$T_I = \frac{\hat{X}_{out,I}}{\hat{X}_{out,I} + \sum_{i=1}^{N_P} \hat{X}_{out,P}[i] + \sum_{j=1}^{N_B} \hat{X}_{out,B}[j]} \times T_{GOP},$$

wherein, $\hat{X}_{out}$ denotes complexity of a picture to be currently encoded, N_p denotes a number of P pictures in a GOP (group of pictures), and N_B denotes a number of B pictures in the GOP.

9. A unit for estimating complexities of pictures, the unit comprising:

a decoded picture information receiving unit which receives complexity information of decoded previous and current pictures;

an encoded picture information receiving unit which receives complexity information of an encoded previous picture; and

a complexity estimation unit, which estimates complexity of a picture to be currently encoded, using the complexity of the decoded previous and current pictures and the complexity of the encoded previous picture.

10. The estimating unit of claim 9, wherein the encoded picture is compressed in MPEG format.

11. The estimating unit of claim 9, wherein if it is assumed that $\hat{X}_{out,I}$ represents complexity of a current I picture to be encoded, $\hat{X}_{out,P}$ represents complexity of a current P picture to be encoded, and $\hat{X}_{out,B}$ represents complexity of a current B picture to be encoded, the complexity estimation unit calculates $\hat{X}_{out,I}$, $\hat{X}_{out,P}$, and $\hat{X}_{out,B}$, respectively, as follows:

$$\hat{X}_{out,I} = \frac{X'_{out,I}}{X'_{in,I}} \times X_{in,I}$$

$$\hat{X}_{out,P} = \frac{X'_{out,P}}{X'_{in,P}} \times X_{in,P}$$

$$\hat{X}_{out,B} = \frac{X'_{out,B}}{X'_{in,B}} \times X_{in,B},$$

wherein, $X'_{out,I}$, $X'_{out,P}$, and $X'_{out,B}$ denote complexities of encoded previous pictures of the current I, P, and B pictures, respectively, $X'_{in,I}$, $X'_{in,P}$, and $X'_{in,B}$ denote complexities of decoded previous pictures of the current I, P, and B pictures, respectively, and $X_{in,I}$, $X_{in,P}$, and $X_{in,B}$ denote complexities of decoded current I, P, and B pictures, respectively.

12. A bit-allocation unit comprising:

a complexity estimation unit which receives a compressed bitstream, performs decoding thereof, outputs decoded pictures, and estimates complexity of a current picture among the decoded pictures; and

a bit-allocation unit which performs desired bit-allocation using the complexity of the current picture.

13. The bit-allocation unit of claim 12, wherein the compressed bitstream is compressed in MPEG format.

14. The bit-allocation unit of claim 12, wherein the complexity estimation unit calculates complexity of a picture to be currently encoded, using complexity of decoded previous and current pictures and complexity of an encoded previous picture.

15. The bit-allocation unit of claim 12, wherein if it is assumed that $\hat{X}_{out,I}$ represents complexity of a current I picture to be encoded, $\hat{X}_{out,P}$ represents complexity of a current P picture to be encoded, and $\hat{X}_{out,B}$ represents complexity of a current B picture to be encoded, the complexity estimation unit calculates $\hat{X}_{out,I}$, $\hat{X}_{out,P}$, and $\hat{X}_{out,B}$, respectively, as follows:

$$\hat{X}_{out,I} = \frac{X'_{out,I}}{X'_{in,I}} \times X_{in,I}$$

$$\hat{X}_{out,P} = \frac{X'_{out,P}}{X'_{in,P}} \times X_{in,P}$$

$$\hat{X}_{out,B} = \frac{X'_{out,B}}{X'_{in,B}} \times X_{in,B},$$

wherein, $X'_{out,I}$, $X'_{out,P}$, and $X'_{out,B}$ denote complexities of encoded previous pictures of the current I, P, and B pictures, respectively, $X'_{in,I}$, $X'_{in,P}$, and $X'_{in,B}$ denote complexities of decoded previous pictures of the current I, P, and B pictures, respectively, and $X_{in,I}$, $X_{in,P}$, and $X_{in,B}$ denote complexities of decoded current I, P, and B pictures, respectively.

16. The bit-allocation unit of claim 12, wherein the target bit-allocation unit calculates a number of bits T_I to be allocated to a current I picture, using the complexity of the current picture, as follows:

$$T_I = \frac{\hat{X}_{out,I}}{\hat{X}_{out,I} + \sum_{i=1}^{N_P} \hat{X}_{out,P}[i] + \sum_{j=1}^{N_B} \hat{X}_{out,B}[j]} \times T_{GOP},$$

wherein, $\hat{X}_{out}$ denotes complexity of a picture to be currently encoded, N_p denotes a number of P pictures in a GOP (group of pictures), and N_B denotes a number of B pictures in the GOP.

17. A bit-allocation method comprising:

receiving a compressed bitstream, performing decoding thereof, outputting decoded pictures, and estimating complexity of a current picture among the decoded pictures; and

performing desired bit-allocation using the complexity information of the current picture.

18. The bit-allocation method of claim 17, wherein the compressed bitstream is compressed in MPEG format.

19. The bit-allocation method of claim 17, wherein in estimating the complexity of the current picture, complexity of a picture to be currently encoded is calculated using complexity of decoded previous and current pictures and complexity of an encoded previous picture.

20. The bit-allocation method of claim 17, wherein in estimating the complexity of the current picture, if it is assumed that $\hat{X}_{out,I}$ represents complexity of a current I picture to be encoded, $\hat{X}_{out,P}$ represents complexity of a current P picture to be encoded, and $\hat{X}_{out,B}$ represents complexity of a current B picture to be encoded, $\hat{X}_{out,I}$, $\hat{X}_{out,P}$, and $\hat{X}_{out,B}$ are calculated, respectively, as follows:

$$\hat{X}_{out,I} = \frac{X'_{out,I}}{X'_{in,I}} \times X_{in,I}$$

$$\hat{X}_{out,P} = \frac{X'_{out,P}}{X'_{in,P}} \times X_{in,P}$$

$$\hat{X}_{out,B} = \frac{X'_{out,B}}{X'_{in,B}} \times X_{in,B},$$

wherein, $X'_{out,I}$, $X'_{out,P}$, and $X'_{out,B}$ denote complexities of encoded previous pictures of the current I, P, and B pictures, respectively, $X'_{in,I}$, $X'_{in,P}$, and $X'_{in,B}$ denote complexites of decoded previous pictures of the current I, P, and B pictures, respectively, and $X_{in,I}$, $X_{in,P}$, and $X_{in,B}$ denote complexities of decoded current I, P, and B pictures, respectively.

21. The bit-allocation method of claim 17, wherein in performing the desired bit-allocation, a number of bits to be allocated to a current I picture is calculated, using the complexity of the current picture, as follows:

$$T_I = \frac{\hat{X}_{out,I}}{\hat{X}_{out,I} + \sum_{i=1}^{N_P} \hat{X}_{out,P}[i] + \sum_{j=1}^{N_B} \hat{X}_{out,B}[j]} \times T_{GOP},$$

wherein, $\hat{X}_{out}$ denotes complexity of a picture to be currently encoded, N_p denotes a number of P pictures in a GOP (group of pictures), and N_B denotes a number of B pictures in the GOP.

22. A transcoding method comprising:

receiving a compressed bitstream and performing decoding thereof to output decoded pictures;

estimating complexity of a current picture among the decoded pictures;

performing desired bit-allocation using the complexity of the current picture;

controlling bit-rate using bit-allocation information and state information from memory, which outputs an encoded bitstream; and

encoding the decoded pictures on the basis of the bit-allocation and state information.

23. The transcoding method of claim 22, wherein the compressed bitstream is compressed in MPEG format.

24. The transcoding method of claim 22, wherein in estimating the complexity of the current picture, complexity of a picture to be currently encoded is calculated, using complexity of a decoded previous and current pictures, and complexity of an encoded previous picture.

25. The transcoding method of claim 22, wherein in estimating the complexity of the current picture, if it is assumed that $\hat{X}_{out,I}$ represents complexity of a current I picture to be encoded, $\hat{X}_{out,P}$ represents complexity of a current P picture to be encoded, and $\hat{X}_{out,B}$ represents complexity of a current B picture to be encoded, $\hat{X}_{out,I}$, $\hat{X}_{out,P}$, and $\hat{X}_{out,B}$, are calculated respectively, as follows:

$$\hat{X}_{out,I} = \frac{X'_{out,I}}{X'_{in,I}} \times X_{in,I}$$

$$\hat{X}_{out,P} = \frac{X'_{out,P}}{X'_{in,P}} \times X_{in,P}$$

$$\hat{X}_{out,B} = \frac{X'_{out,B}}{X'_{in,B}} \times X_{in,B},$$

wherein, $X'_{out,I}$, $X'_{out,P}$, and $X'_{out,B}$ denote complexities of encoded previous pictures of the current I, P, and B pictures, respectively, $X'_{in,I}$, $X'_{in,P}$, and $X'_{in,B}$ denote complexities of decoded previous pictures of the current I, P, and B pictures, respectively, and $X_{in,I}$, $X_{in,P}$, and $X_{in,B}$ denote complexities of decoded current I, P, and B pictures, respectively.

26. The transcoding method of claim 22, wherein in performing the desired bit-allocation, a number of bits to be allocated to the current picture is increased if the complexity of the current picture is large, and the number of bits to be allocated to the current picture is decreased if the complexity of the current picture is small.

27. The transcoding method of claim 22, wherein in performing the desired bit-allocation, a number of bits to be allocated to the current picture is estimated using the complexity of the current picture.

28. The transcoding method of claim 22, wherein in performing the desired bit-allocation, a number of bits T_I to be allocated to a current I picture is calculated, using the complexity of the current picture, as follows:

$$T_I = \frac{\hat{X}_{out,I}}{\hat{X}_{out,I} + \sum_{i=1}^{N_P} \hat{X}_{out,P}[i] + \sum_{j=1}^{N_B} \hat{X}_{out,B}[j]} \times T_{GOP},$$

wherein, $\hat{X}_{out}$ denotes complexity of a picture to be currently encoded, N_p denotes a number of P pictures in a GOP (group of pictures), and N_B denotes a number of B pictures in the GOP.

29. A method for estimating complexities of pictures, the method comprising:

receiving complexity information of decoded previous and current pictures;

receiving complexity information of an encoded previous picture; and

estimating complexity of a current picture to be encoded, using the complexity information of the decoded previous and current pictures and the complexity information of the encoded previous picture.

30. The complexity estimating method of claim 29, wherein the encoded picture is compressed in MPEG format.

31. The complexity estimating method of claim 29, wherein in estimating the complexity of the current picture, if it is assumed that $\hat{X}_{out,I}$ represents complexity of a current I picture to be encoded, $\hat{X}_{out,P}$ represents complexity of a current P picture to be encoded, and $\hat{X}_{out,B}$ represents complexity of a current B picture to be encoded, $\hat{X}_{out,I}$, $\hat{X}_{out,P}$, and $\hat{X}_{out,B}$, are calculated respectively, as follows:

$$\hat{X}_{out,I} = \frac{X'_{out,I}}{X'_{in,I}} \times X_{in,I}$$

$$\hat{X}_{out,P} = \frac{X'_{out,P}}{X'_{in,P}} \times X_{in,P}$$

$$\hat{X}_{out,B} = \frac{X'_{out,B}}{X'_{in,B}} \times X_{in,B},$$

wherein, $X'_{out,I}$, $X'_{out,P}$, and $X'_{out,B}$ denote complexities of encoded previous pictures of the current I, P, and B pictures, respectively, $X'_{in,I}$, $X'_{in,P}$, and $X'_{in,B}$ denote complexities of decoded previous pictures of the current I, P, and B pictures, respectively, and $X_{in,I}$, $X_{in,P}$, and $X_{in,B}$ denote complexities of decoded current I, P, and B pictures, respectively.

32. A computer readable medium having embodied thereon a computer program for a transcoding method, the method comprising:

receiving a compressed bitstream and performing decoding thereof to output decoded pictures;

estimating complexity of a current picture among the decoded pictures;

performing desired bit-allocation using the complexity of the current picture;

controlling bit-rate using bit-allocation information and state information from memory, which outputs an encoded bitstream; and

encoding the decoded pictures on the basis of the bit-allocation and state information.

33. A computer readable medium having embodied thereon a computer program for a picture complexity estimation method, the method comprising:

receiving complexity information of decoded previous and current pictures;

receiving complexity information of an encoded previous picture; and

estimating complexity of a current picture to be encoded, using the complexity information of the decoded previous and current pictures and the complexity information of the encoded previous picture.

34. A computer readable medium having embodied thereon a computer program for a bit-allocation method, the method comprising:

receiving a compressed bitstream, performing decoding thereof, outputting decoded pictures, and estimating complexity of a current picture among the decoded pictures; and

performing desired bit-allocation using complexity of the current picture.